

Claims

We claim:

1. A method of lining a cylinder bore of a reciprocating piston internal combustion engine aluminum engine block comprising:

5 spraying said cylinder bore with a gas-dynamic cold spray to coat said cylinder bore with a lining material differing from a material of said engine block.

2. A method as described in claim 1, further including initially coating said cylinder bore with a first material having a first level of heat transfer resistance, and then coating said cylinder bore with a second material having a  
5 second level of heat transfer resistance greater than said first level.

3. A method as described in claim 1, further including first coating said cylinder bore with a first material having a first level of adhesion with said aluminum of said engine block, and then coating said cylinder bore with a second  
5 material having a second level of adhesion lower than said first material, and said second material having a hardness greater than said first material hardness.

4. A method as described in claim 2, further including first coating said cylinder bore with a first material having a first level of adhesion with said aluminum of said engine block, and then coating said cylinder bore with a second  
5 material having a hardness greater than said first material hardness.

5. A method as described in claim 1, utilizing a nozzle to spray said lining material and wherein said nozzle and said cylinder bore of said engine block have relative movement with respect to one another.

6. A method as described in claim 5, wherein said nozzle is translated up and down through said cylinder bore.

7. A method as described in claim 6, wherein said nozzle is positioned along a longitudinal center axis of said cylinder bore.

8. A method as described in claim 5, wherein said nozzle is angled at  $30^{\circ}$  plus or minus  $15^{\circ}$  from a surface of said cylinder bore.

9. A method as described in claim 5, wherein said cylinder bore is coated in multiple passes.

10. An internal combustion engine comprising:  
an aluminum engine block having at least one  
cylinder bore for mounting a reciprocating piston therein; and  
a lining of said cylinder bore of a material  
5 differing from a material of said engine block, said material  
being provided by a gas-dynamic cold spray.

11. An internal combustion engine as described in claim 10, wherein said cylinder bore lining includes a first lining material and a second lining material.

12. An internal combustion engine as described in claim 11, wherein said second lining material is harder than said first lining material.

13. An internal combustion engine as described in claim 11, wherein said first lining material has better adhesion with said aluminum block than said second lining material.

14. An internal combustion engine as described in claim 11, wherein said first lining material has less heat resistance than said second lining material.

15. An internal combustion engine as described in claim 12, wherein said second lining material has less heat resistance than said first lining material.

16. An internal combustion engine as described in claim 1, wherein said lining is applied axially within said cylinder bore.

17. A spray gun for spraying a cylinder bore of an aluminum engine block with a gas-dynamic cold spray to coat the cylinder bore with a lining material, the apparatus comprising:

- 5           a metering feeder;  
            a supersonic nozzle, said nozzle being angled at 30° plus or minus 15° of an axis of said cylinder bore.

18. A spray gun as described in claim 17, wherein said nozzle can be rotated.

19. An apparatus as described in claim 17, wherein said lining material is first accelerated generally parallel with the longitudinal axis of said cylinder and, said lining material is then angled at said  $30^{\circ}$  plus or minus  $15^{\circ}$  angle and  
5 said material then passes through said nozzle before exiting said spray gun.